The Second Book of the Art of Mettals.

CHAP. I.

That no man ought to be employed to Refine Mettals, but he that hath been examined and Licenſed by Authority.

THe abundance of Minerals, wherewith God hath enriched almoſt all the Provinces of this new world (ſerving himſelf thereof as a Medium, to other high deſigns of his Divine Providence) hath been ſo great, that it is ſcarce poſſible to be believed. The Mountain and Imperial City of *Potoſi*, having already

yielded, between four and five hundred Millions of Peeces of Eight, a quantity ſufficient to make ſuch another hill of Silver; it is hard to form a conception equal unto ſo exorbitant a heap of Riches; but the better to help our imagination therein, know that, if the ground were covered with Peeces of Eight, laid as cloſe to one another, as is poſſible, they would take up the ſpace of ſixty Leagues ſquare, allowing five and twenty Peeces of Eight to a *Vare of Spain* (a Vare of *Spain* is 33. *Engliſh* Inches) and five thouſand Vares to a *Spaniſh* League. This glut of Riches, hath been the reaſon why they have not applyed the care that was requiſite, to prevent loſs and waſte in the Refining of Oar, which ſpeaking with moderation, hath been the loſs of many Millions, both for want of giving it due Law, the nature, and difference whereof, they did not underſtand; and ſo proceeded by chance, and without good ground, neither knew they well, what quantity of Plate the Oar would yield. And laſtly, they deſtroyed unneceſſari-

neceſſarily abundance of Quickſilver, whereof hath been already conſumed in this Imperial City, more than 234600 Quintals; I know not whether this neglect ſpeaks greatneſs of mind in the inhabitants of this Kingdom, that they deſpiſe to pick up Crums, which nevertheleſs were ſufficient to ſatisfie the hunger of many Kingdoms of the other world; or whether it condemns the careleſsneſs of ſo wiſe and well governed a Commonwealth, that they have not uſed all poſſible means to put a ſtop to ſo unneceſſary a Prodigality. The firſt and fundamental remedy whereof, is in my opinion, that the Mettals be Refined by one that underſtands the Art, and is Authorized thereunto by Publick Licenſe, after ſtrict examination of his ſufficiency, which is required before the admiſſion unto divers callings in the Commonwealth, without compariſon of much leſs importance than this is. The Maſters of Refining Works have taken no Care at all in this matter, becauſe how negligently ſoever they Refine their own Oar,

they lose nothing, but have all the Silver, either in the Plates, or amongst the Dross; and that which they Refine for others, yields more profit to these Refiners, the worse it is wrought, because more remains with them in the Dross; but both these are ill reasons to proceed upon, because the making full profit of their own, must cost a double labor, and the ill Refining other mens, redounds to a Publick prejudice.

CHAP. II.

what quantities, and what kind of knowledge a Refiner ought to have.

IT is a very great Trust that is put into the Refiners, the whole Riches which this most prosperous Country produceth, being put into their hands without account, or any obligation of the quantity they are to return; their word and honesty only, without reply, or appeal from their sentence, is the only security of the truth, of what the

Oar

Oar hath yeilded; and it had need be a ſtrong ſecurity, when the violent incitation of private intereſt is to deceive. He therefore that liveth continually amongſt theſe occaſions, had need be well furniſhed with the honor of a Chriſtian, leſt having his fingers perpetually kneading in the paſte, a good deal do not ſtick unto them; there ought to be a great deal of circumſpection in chuſing this Officer, for no miſchief that hinders the Refining of Oar, or extravagant conſumption, or loſs of Quickſilver, can occaſion ſo great prejudice as a Refiner of a wicked Conſcience.

Neither yet is it alone ſufficient, that his Manners be good, if he want the knowledge neceſſary to the Art of Refining. He ought to know all ſorts of Mettals, their qualities and differences, which of them are moſt proper for Quickſilver, and which for Melting, if there be conveniency for it. He ſhould know the diſeaſes alſo that infect Mettals, and the way of clearing them; the accidents of Quickſilver, and the ordinary way

of Refining in great and in little; and in no case let him be admitted for a Refiner, that doth not well understand how to make the lesser Ensay by the Fire, of Oar that is ground to powder, before the Mettal be incorporated together, that so he may know certainly how much Silver ought to be gotten out of that Oar; and he should never give over making tryals, untill he hath obtained it. The want of this one care hath cost this Kingdom abundance of Mony, and is of great prejudice to it, even at this day; two experiments whereof I shall relate, which have passed through my hands, that you may the better estimate the importance of this advice: A few years ago, when I lived in the Province of the *Lipes*, in a Parish which they call *Xauquegua*, a Miner had wrought a Vein, out of which he drew a quantity of very Rich Mettal, although he knew it not; he Ensayed it by Quicksilver, and found it to contain four or five Peeces of Eight the Quintal, and at that rate Refined it all by the great; at length they deserted

ſerted the Mine for being of little profit: Afterwards an *Indian* carried me to the place, I found Mettal in the Moulds that were drawn out, and alſo in the Vein which had not been much wrought, I Enſayed it by the fire, and found it to contain 900 Peeces of Eight the Quintal, although by the ordinary way of Quickſilver it yeilded but four or five; I diſcovered this Vein to the Magiſtrates, calling it by the name of *Nueſtra Senora de Begomia*; they built a Mill preſently near it, and abundance of Miners flocked thereupon, and have gotten thence a great quantity of Silver.

In the Mountain of *Santa Juana*, out of the Mine of *Berenguela de Pacages*, they got a Mettal like unto *Soroches*, which by the ordinary Enſay with Quickſilver, appeared ſcarce to have any Silver at all in it; whereupon the Miners utterly deſerted it, untill a Prieſt a Friend of mine, ſent me ſome peeces thereof unto *Oruro*, which I Enſayed, and found them to contain 60 Peeces of Eight the Quintal; by my advice he dug a great

great quantity of that Mettal, being laughed at by the Neighbors whileſt he was at work to ſo little purpoſe (as they thought) but afterwards much more envied by them for the great riches he had gotten.

CHAP. III.

Of the knowledge of Mettals, and the diſferences there are of them.

IT is almoſt impoſſible to teach thoſe, that have not been acquainted with Mettals, how to know them by the ſight, becauſe there is ſo great diverſity of them; that there is ſcarce any ſtone in one Mine, that reſembles ſtones of the ſame Mettal in another Mine; no nor oftentimes of the ſame Mine it ſelf. Nevertheleſs the Miners reduce theſe differences unto three general heads, which the *Spaniards* call, 1. *Pacos*, 2. *Mulatos*, and 3. *Negrillos*. *Paco* in the general language of this Country, is as much as to ſay of a Red colour,

and

and ſuch more or leſs are the Stones, which they call *Metal Paco*, although in *Berengula de Pacages*, they call the Green Mettals of Copper by the ſame name, which alſo in theſe Provinces they give to Mettal of any colour, in contra-diſtinction to Mettals, that ſhine like Steel or Glaſs, and another ſort which they call *Negrillos*. *Mulatos* is a colour between the *Pacos* and *Negrillos*; and in the Mines, Mettal of that colour is produced in the ſame order; it is of a Brown colour, and ordinarily accompanied with ſome of the *Margagita*; there is leſs of this Mettal, than of the two other ſorts. The *Negrillos* have been diſcovered by, and take their name from their colour, although all Black Mettals are not comprehended under that name. *La Tacana* a rich Mettal, and uſually Black, although there be of it Grey and Aſh-coloured, which they call *Lipta* belongs to the *Metals Pacos*, as alſo doth the Lead (for ſo they call the Silver Oar) which oftentimes is Black, Grey, Aſh-coloured, Green, White, and Orange Tawny, which they

they call *Saco*; and this last year in the Mountain of *Potosi*, there was found of it, of a bright lively Cinamon colour, or very fine Vermilion, a thing which hath not been seen in any other Mine. The *Soroches* might constitute a fourth order of Mettals, but I agree with the opinion of others, that would have them ranked under the name of *Negrillos*, to which also belongs the *Rosicler*, the richest Mettal that nature hath produced in the form of a Stone; it is shining and brittle, and the powder of it beaten finer with any hard thing, is of the colour of pure blood, it is very like unto *Cinabrio*, or that Vermilion which is made of Quicksilver and Sulphur, which gives a good hint for the finding out of divers other greater secrets. *Cochico* is also of the same kind a very rich Mettal Massy, but neither so brittle nor spungy as the *Rosicler* is, but it is more full of Lead, and is not so easily beaten to powder, nor gives so perfect a blood colour.

Soroches, *Tacana*, *Polvorilla*, *Rosicler*, *Cochico*, and *Negrillos*, are distinguished one

one from another, in the manner following.

The *Soroches* are black, or Ash coloured, either shining, or without any lustre (which they call dead Oar of Lead) and commonly contains some Silver.

The *Tacana* is Silver Oar close compacted, of a Black colour, without any shining at all.

Polvorilla is *Tacana*; not congealed, nor stony, but is rich in that Oar they call *Pacos*, but in the *Negrillos*, not so much, by reason of the mixture of Copper, that it hath.

The *Rosicler* and *Cochizo* is Silver Oar with that same Varnish, which hides its own proper colour, and shines, whereby it differs from the *Tacana*. That which predominates in the *Negrillos*, is Copper, either actual, or else Vertual in the Copperas, wherewith it abounds; it always contains Silver more or less, and is usually accompanied with the *Margasita*.

The Black Mettal which feels like Lead, and is smooth (which makes as it

were

were Leaves of Trees or Feathers) contains a great deal of *Alcohol*, or Antimony (which in some parts they call *Magnesia*) and but little Silver. Those *Negrillos* which have lustre like polished Steel, or Looking-glass, and are therefore called *Espejado* and *Acerado*, are the richer the neaer they approach unto the *Rejicler* and *Cochico*.

CHAP. IV.

Of the sorting of Oar, and the proper manner of Refining each of them.

THE skill of extracting all the Silver, out of any Oar, begins to be exercised in the picking and sorting of the Oar together; the want of care in sorting Oar from Stones, that have no Oar in them, as also the Oar of one sort of Mettal from another, hath occasioned much damage; the least inconvenience hath been in the use of Quicksilver, a quantity whereof is lost together with grinding, and other charges about that which is no Mettal; the greater inconveni-

venience hath been, where there was Mettal, the failing to get out all the Silvery because they have jumbled together Oar of several sorts, and used but one manner of Refining, whereas those Mettals require a different way of handling and time. To Essay that Mettal by Quicksilver, that requires the fire, is to destroy it; to put that Mettal in the Furnace, which is not to run, is to endamage the Mettal, and to get no profit at all; and although the several Oars be properly assigned, some to the Quicksilver, and some to the fire, yet they have their differences of being easier or harder to be Refined according as they concur, or differ in the remedy, that is necessary to be used for that purpose. The Oar, which they call *Pacos*, that shines or sparkles not at all, is proper for Quicksilver. The *Tacana* also may be refined by Quicksilver, but because it is so very rich Oar, lest it should not be clean extracted, but part of it remain in the Dross, it is better to melt it in a bath of Lead. That Oar which containing Silver in it, yet they

they call by the name of Lead Oar, if it be over grosse, will neither grind well, nor cleave fast to the Quicksilver, and is best to be melted together with the *Tacana*.

The most proper way of dealing with the Oar, they call *Anachacado*, is the Hammer, the *Sorocher* need the fire, the *Rosocler* and *Cochico* are to be melted like the *Tacana*; the *Negrillos* require both fire and Quicksilver, for they prepare all the Oar of that kind by the fire, for the Quicksilver by that means collecting the Silver, either burnt, or boyled, as shall be shewed hereafter.

CHAP. V.

How to know the ill qualities that infect the Oar, and how to purge them away.

OF various and very different qualities are the substances that Nature hath produced in the Veins, that contain the Oars of Mettals, whether they

they be Abortions which the covetouſneſs of Mankind occaſions by tearing the Oar out of the bowels of the Earth before its full time, which otherwiſe would come to be Mettal in perfection, or whether it be excrementious ſuperfluities of the generation of all ſorts of Mettals; they be uſually called Semi-minerals and are Salts, Allum, Copperas, Sulphur, Orpiment, Sandaraca, Antimony, or Alcohol, Brimſtone, both White and black, and Margagita.

Scarce any Oar is gotten that doth not participate of one or more of theſe ill companions, all of them being hindrances to the extracting Silver out of the Oar, whether it be by the Fire or Quickſilver; thoſe that partake of Copperas, of which ſort are thoſe they call *Copaquiras*, are mortal enemies of Quickſilver, which they conſume and ſcatter, and that ill condition is heightned, if Salt be mingled with it, which makes it penetrate more violently, and ſuddenly; the learned *Raimundus* knew this antipathy very well, and hath left it diſcovered to us in writing; and

those that deal in Mettals daily have it in their hands, and yet take no notice of it; this is that, which eats up the Quicksilver, and dissipates the Caxomes of Mettal, and hath occasioned so great an expence of Mettals, namely, Iron, Lead, Tinn, and Lime. Whosoever hath a mind to make experiment hereof, let him mix a little Quicksilver with Copperas well ground, and water, and he shall see in an instant all the Quicksilver dissolved and lost; especially if he put a little Salt to the former composition. This will be no wonder to those that know *Mercury* to be Quicksilver, and that the great change in its substance, is caused by Copperas and Salt, wherewith it is mingled, and then sublimated in the heat of the Fire; this is the greatest poyson to the refination by Quicksilver; although sometimes it is useful, and serves like Treacle to those sorts of Oar, which have use of it, as shall be shewed in it's place hereafter.

This inconvenience is found out, and remedied, with very much ease; grind a lit-

a little Oar, and put ſome fair water to it, heat it the more the better, ſtir it well, and then let it ſtand a while, then pour out the clean water into another veſſel, leaving the Sedement behind undiſturbed, prove it by the taſte, and you ſhall well judge what mixture it hath, by it's dry or ſoure taſte; and whoſoever deſires an occular demonſtration of this, let him ſet the aforeſaid water upon a gentle Fire, ſimpering untill the moyſture be conſumed, and he ſhall ſee with his eyes, in that which remains at the bottom, either Allum or Copperas. Bathe the Oar in the manner aboveſaid, ſo often as ſhall be neceſſary, untill the water, that comes from it be ſweet, and without taſte, or that ſtirring it with a bright peece of Iron, it doth not ſtain it with the colour of Copper, and then that Oar is perfectly cleanſed and ſecure, not to hurt the Quickſilver, when it is put unto it.

Although Sulphur, Betun, and Antimony do oftentimes diſcover themſelves unto the ſight, yet a better way

of finding them out, is by the ſmell, which comes from the Oar, when it is well burnt in the Fire; but for fuller ſatisfaction herein, they may be diſcovered and cleared from the Oar in the manner following.

Grind the Oar ſomewhat groſs, and put it in an earthen Pipkin that is not glazed, that hath a great many ſmall holes in the bottom of it, and ſtop the mouth of it cloſe, then fit a Veſſel of water round about it, in ſuch manner as they do, when they clear the Pine Apples from Quickſilver, and put fire under the ſame Baſon of Water, wherein all the ſmoak that goes out of thoſe little holes will ſettle, and there you ſhall ſee congeal'd and ſwimming upon the top of the Water, the Sulphur, Antimony or Betun, each in his proper form. When the Oar will ſmoak no longer, it is a certain ſign that it is clear of thoſe impediments, which although they be not direct enemies to Quickſilver in raw Oar, yet the Varniſh which they give to the ſilver, hinders the Quikſilver from laying hold of it, and uniting

uniting it together; and by the brittleneſs and aſperity like Glaſs which thoſe Oars have that participate of the impediments aforſaid, they cut and divide the Quickſilver when they are ſtirred together into ſmall White pins heads as it were, which the *Spaniards* call *Lis*. It is neceſſary to burn this ſort of Oar, although it be good to melt them firſt before they put them into the fierce Fire, becauſe without that preparation the Silver will all be turn'd into droſs.

The *Margagita* that is in Oar, diſcovers it ſelf but too plainly to the eye by its weight and ſharp glaſſie quality, it divides the Quickſilver into ſmall *Lis*; when they ſtir them together, thoſe ill qualities are taken away by the Fire, if you burn it therein untill its gloſs and ſhining be gone, it doth moſt hurt unto that Oar which they melt, the abundance of Sulphur whereof it is compounded making a great ſcum upon the face of the Liquor, which much ſtifleth the fundition.

CHAP. VI.

Of the Grinding of the Oars of Mettal.

THe Grinding of Oar is a preparation absolutely necessary for the getting out of it, the Silver, or Gold that it contains by Quicksilver, and the fineness of the Meal is a principal means of shortening the work and clear extraction of the Plate: one fault amongst many, which the blockishness of this Country has committed, hath been to make the meal very gross, or to leave many lumps therein; there needs no great pains to prove that the Quicksilver attracts or incorporates with it self that Silver which it immediately touches; so that the Mettal which is in middle of any lump remains in the same condition it came out of the Mine, and has more or less loss in it, according to the richness of the Original Oar, and according to the richness or coursness of the Meal. I have made divers tryals of Grinding those lumps over again, and find

find that in them remains, when least, the sixth part of what is in the Oar when it is first taken out of the Mine, which is very considerable in a whole years work, and incredible in the great quantity of Mettals that have been already gotten. *Agricola* after having taught the way of Grinding & sifting of Mettals which they now practise in the Mills, teaches a way how to reduce it to extraordinary fine Flower in a kind of horse Mill with Stones like Mill stones: he thought this pains to be necessary, although to an end different from that refining which we now practise, wherein it is clearly and indispenseably necessary. I learn't the manner of doing this from one that had gotten a great deal of mony by Grinding the lumps over again, although he did not take out all the Plate, because he ground them in an ordinary Mill, whose Hammers could not beat it so small as it ought to be, for the lumps either slip'd away from under the Hammer, or being uneven one defended the other from the stroke; to have good Sives, and care

in lifting them up is of great importance to this matter, but not a full remedy, after the washing of the Oar, especially if it were of rich Mettal is the best gathering up of lumps to regrind. If they burn the lumps, they will yield more Flour, because some of the lumps will calcine and be smoother, and others will swell and grow more spungy, whereby the blow of the Hammer will have better effect upon them. I do use another way of preparation by boyling, as shall be shewed hereafter, which I do hold more proper to be used in all refination by Quicksilver; put the Oar ground and searsed into a skillet in like manner (as if it were already incorporated with Quicksilver, and ready for washing) then pour a sufficient quantity of water upon it, stirring it with a Ladle or hand-mill, whereby all the fine will swim a top, and the gross and ill ground will sink to the bottom; take away the fine with a ladle, put it in the melting pot and boyl it, grind the grosser part again in a Mill or a Morter untill it become all meal; If I desire to

make

make a Xoves of the fine ſort after the ordinary manner of refining, I muſt mingle ſome pure ſand therewith, that it may ſwell and want the Inconveniencies which that kind of Oar uſeth to be accompanied withall.

CHAP. VII.

Touching the Burning of Oar.

THe Burning of Oar is uſeful for two purpoſes, *viz.* 1. That it may Grind the better. 2. That it may be in better diſpoſition for the Quickſilver to lay hold of, and incorporate it ſelf with the Silver that is in it. The reaſon of the firſt is plain, and the experience of the latter, ſince they order all the Negrillos or blacker Oar in that manner, but generally not underſtanding the reaſon thereof. And certainly in all the art of refining nothing is practiſed ſo much by gueſs or chance, and without knowing the ground of it, as this is. Refiners will ſay, they burn the

the Oar to clear it of ill qualities, not apprehending that thence it will follow that by fire enough they should quite cleanse and purifie it, whereas the contrary is found by experience, and that according as they burn it more, the worse conditioned is the Oar, and needs the help of some other material to prevent, that all the Silver and Quicksilver too, that is in it, be not lost.

There is but one enemy naturally opposite unto Quicksilver (as hath been said already) and that is the Copperas, and the fire is not only useless for the vanquishing that, but on the contrary it multiplies and encreases it; and if the Oar have no Copperas in it when it is put into the fire, the fire will beget and produce it, as may easily be seen by experiment. In the Burning of Negrillos (or black Oar) in which the fire encreases the Copperas so much, that it is necessary to use other materials in the burning of it to repair that dammage, although if they had throughly understood this matter, they might have

have cheaper and easier done it, by washing the Oar (as I have said before) untill it were cleared of all the Copperas. The ignorance of which remedy hath been the occasion of great waste and loss.

Other diseases of Oar do not directly injure the Quicksilver, only by the Varnish and Glassie quality which they give, they hinder the Plate and Quicksilver from incorporating and making a Mass together; and therefore the rule in this case is to burn the Oar so long untill it change colour and lose the lustre and sparkling that it had. To know the Oar that of necessity must be burnt (if it be to be Refined by Quicksilver) the lustre and shining aforesaid is a certain sign. The fire will not prejudice that Oar they call Pacos, and if it have any mixture of the aforesaid impediments, it must of necessity be burnt.

CHAP.

CHAP. VIII.

Touching the dammage that results from the burning of Oar.

MEn having hitherto proceeded by chance as it were, and without certain knowledge of the quantity of Silver contained in a peece of Oar, have judged him the beſt Refiner that has gotten moſt Silver by one operation, leaving it doubtful whether any more or no were to be gotten out of the Oar, eſpecially in the Negrillos and Oars that cannot be excuſed from burning. This doubt has been greater, there being leſs certainty here where there ought to be much the greater; and from hence men have found no leſs inconvenience by miſtaking on the one hand, than on the other; wherefore this manner of preparation hath been eſteemed, as dangerous as profitable. With skill and curioſity one may obſerve many wonders of Nature in the burning of Oar, the parts of Iron and Brimſtone, which commonly

monly accompany the Oar, when they come to the fire are converted into Vitriol or Green Copperas; this afterwards is turned into fine Copper; again, the Copper calcined, diſſolves in water like ſalt, the which ſtrain'd and evaporated by a gentle heat coagulates into another kind of Vitriol or blew Copperas, like unto that which they call the ſtone *Lipes*, and is of admirable Virtue for the turning of almoſt all Mettals into Copper, the purity of Silver it ſelf does not excuſe it from being ſubject to ſuch a metamorphoſis, for if the Oar have in it any Allum, Copperas, Saltpeter, or Nitre by the help of the fire, they will calcine the Silver ſo, that it will diſſolve in water, and not be lay'd hold on by Quickſilver without uſing ſome new Artifice, and even Salt alone as it grows incorporated in the Oar, or mingled with it in the fire is capable of producing the ſame effect as ſhall appear evidently in the following experiments.

CHAP.

CHAP. IX.

Experiments which prove the damage by the burning of Oar if they be not known and remedied.

GRind a peece of Oar that has Copper or Iron in it, and by the direction of the fifth Chapter of this Book, try if there be any Copperas in it, and if there be, clear the Oar of it by washing of it, and after it is dry burn it well, and put it into water again, and you shall see much Copperas anew produced by the fire; the Refiners daily do this with their hands, although they take no notice of it; and although this experiment be sufficient to satisfie every body, yet for greater confirmation of this secret to grind Oar of Copper or Iron, and melt it into thin Plates, and grind some Sulphur, and in a Crusiple or Earthen pot unglaz'd, put a lare of that Sulphur, and upon that lay one of the Plates, and proceed in that order as far as you think fit, stop the

the mouth of it well, that it give no vent; and after it is dry, put it between red hot Coals in such manner as they encompass it round about, but do not touch it; after the Crusiple is sufficiently hot, put the fire neerer to it, and at last make the fire fierce; but not so much as to melt the Plates; then take it out and the Plates will look black and be brittle, grind them very fine, and put the fourth part of their weight of beaten Sulphur, together with them into a peece of broken pot or earthen Bason upon Embers, heat them so as you heat an Essay of the black Oar, stirring them continually untill the Sulphur have left smoaking, and the oftener you repeat this the better; last of all being well beaten and hot, or else the water hot, and after a little time boyl the water, and if it colours bright Iron of a Copper colour, that the water evaporate by a gentle fire, untill it begins to be covered with a kind of Cream, then take it off and set it a cooling, and it will congeal into most beautiful transparent Copperas, Green if the Plates were

were of Iron, or blew if the Plates were of Copper.

Dissolve this Copperas or Stone *Lapis* in water, and put Steel or Iron to it, and it turns into most pure Copper, smooth, and soft as gold after it is new melted. If one melt Lead or Tin, and pour it in small drops upon the face of that water, the whole superficies will be turned into Copper, and the oftner it is repeated, the greater quantity of the Lead will be transformed untill no Lead remain.

Tin is very easily turned into brass. I was the first which in the Province of the *Lapis* found out and published these secrets. Also Silver is turn'd into Copper if it be made very fine, and with much Salt (an experiment which ought to be as highly esteemed by the Refiners, as the turning Copper into Silver) *Aqua fortis* is a common thing, if it were not, its vertue would be held miraculous, it turns Silver into Water, and calcines it into dust; it is made of Copperas or Allum and Salt-peter, the Spirits that flye from any of these substances, when

Oar

Oar that contains them is cast into the furnace, works the same effects: with beaten Brick and Salt especially of the rock is made a Cement, wherewith they separate Silver from Gold; these two attract the Silver to themselves and with the heat of the fire only calcine it; in the burning of Oar they have the same effect; the Silver being calcin'd in either of the aforesaid manners if it be put into water dissolves in it like Salt, and the Water looks white as milk, and will spot ones hands or nails if you touch it, notable signs of *Aqua fortis* in Silver, whereunto Refiners ought to have great regard, that it destroy not their Silver; these inconveniencies there are in the burning of Mettals, besides another which anon shall be discovered, and though the proper way of avoiding them is casting or melting the Oar which renders useful, not only that Mettal which is precious, but also the baser sort, as shall be shewn in its place, nevertheless because all places do not afford conveniencies for melting down Oar, nor all Oars contain

Mettals ſoh enough to pay the coſt, let the aforeſaid inconveniencies when they happen be remedy'd according to the rules which ſhall be ſet down hereafter, although it be impoſſible to prepare Oar without burning ſo as to yeild that quantity of Plate it did by Quickſilver, as ſhall be ſhewn where the refination by boyling is treated of.

CHAP. X.

Whether the Oar ought to be burnt in the ſtone or in the meal.

THey uſe to burn Oar in the Stone or in the Meal, and burning it in the Meal, they better underſtand the nature of the Oar, for taking care to ſtir it well about, and mix it equally in the Furnace, taking out a ſmall quantity, and putting Quickſilver and Salt thereunto in a ſhort ſpace of time; by the diſpoſition of the Quickſilver you ſhall quickly know what the Oar is, whether it begin to grow like Lead or no,

no, and whether the Lead be grosse or fine, or whether there be need of more materials or no, or whether to continue, or stop the burning of it, according as every Refiner by his own experience hath found to succeed best with it out of that Oar which is burnt in the stone, cannot be chosen this equality, because the force of the fire cannot be equally communicated to stones in a divers situation and of different bigness; for it is clear that the small stones are sooner heat than the greater, and those that are in the Center of the Furnace, sooner than those that touch the sides; but this manner of burning is subject to least damage, besides that it facilitates the grinding of the Oar.

It is a great error to burn Oar already grownd by reverberation, because the fierceness of the fire, burn the Sulphur or Betun which it contains, and suffer it not to discharge it self by little and little, but obligeth it to mingle it self with the Silver, and altogether to turn it into dross; moreover the force of the flame raises up the setled parts of the

Silver, when they stir the Oar, and turning it into smoak, blows it out of the Furnace. The most secure way of burning Oar already grownd, is to do it by a Tostadillo (or preserving Pan) made in the fashion of a Furnace, as shall be directed hereafter, and because the Meal is wont by the fire to gather into little lumps, or else to grow spungy and gross, it is convenient to grind it over again, before it be incorporated, the best way of all as has been said were to burn it in the stone, because it facilitates and saves a great part of the grinding, and avoids the inconvenience of the fine Silver flying away in the smoak, and where the Oar is incorporated in hard Peble and Flint, which are very untractable stones, it is necessary to burn them. Other sorts of Oar ought not to be burnt alone, but in Meal with the mixture which shall be prescribed according to the ill qualities wherewith they are affected.

CHAP.

CHAP. XI.

Of Materials to be mixed with Oar, when they burn it.

IT is no extraordinary, but a common thing for Iron to be engendered in the Gold and Silver Oar, and the Oar, that is so affected, is most difficult for burning or fundition either; it may be discovered by the slowness of the heat's penetration into it, and also by a Loadstone, passing it over the Oar, after it is well burnt, and grownd, which will snatch up the Iron, if there be any, and more or less of it, according to the quantity mixt with the Oar. This kind of Oar after it is grownd, ought to be mixed with Sulphur, or which is better with the Meal of Oar that hath Sulphur, or Antimony in it, and in such proportion as the quantity of Iron in the Oar requires: when they are mingled, heat them upon the Tostadillo untill that taking out some of the Meal, and Ensaying it according to custome;

the Oar is found to be well conditioned. Sulphur is the destruction of all Mettals, gold only excepted; it hurts Tin less than other Mettals, and Iron most of all, and that is the reason why the Sulphur, and Iron combating with, and destroying each other in the Furnace, the Silver is left alone by its self. In like manner is Oar cured, that contains Sulphur or Antimony, being mingled and burnt with the Oar, or dross of Iron after it is well grownd.

That Oar which contains Orpiment, or Sandarca, ought to be burnt which Soroches, which is Oar of Lead and Sulphur; that which contains Betun black or white must be burnt with dross of Iron, and pouder of white stones, whereof they make Lime: Besides what hath been already said, the diseases of Oar may be known by putting a little of it grownd somewhat gross upon a red hot plate of Iron, observing well what fume it makes, which if it be white or black, participates of Betunes of that Colour, if it were yellow of Orpiment, if red of Sandaraca, if it be yellow in the

the middle, and green on the out sides, of Sulphur, and likewise the earth that is drawn out of the Mines, together with the Oar, will oftentimes send forth fumes of the like kind of colours.

CHAP. XII.

What the Refiner must do before he incorporates the Caxon.

THe Refiner throughly understanding what has been said before, the Oar being well grown'd & cearsed with that curiosity and circumspection which is necessary (so that it need not be picked) Before he doth go about to incorporate the Caxon, and before he burns the Meal, if there were need thereof, let him set apart three or four pound of the Flower well mingled, and stirring it together again afresh, take a small quantity, & make two Ensays thereof by melting in such manner, as shall be shewed hereafter; whereby he shall certainly know what Silver the Caxon contains, and how much he may expect to get out

of it. Laying down this ground, that the Oar is of that they call *Pacos*, and needs not burning, nor contains Copperas, nor Coppaquillas, take out some in the manner abovesaid, and Essay a pound of it by Quicksilver, but first pour upon the Oar a good deal of fair water, more than is ordinarily necessary, and let it stand a while, and if there arise a scum, or cream, that is gross, or oily, scum it off, and let that water run out, and repeat the same with fresh water, so often, untill no such scum arise, then take out so much water as is superfluous, and put Salt and Quicksilver to it, and without any other material proceed in repeating, to cast in those too, marking well the operation of the Quicksilver, whether by accident it meets with more Quicksilver; whether it turns little or much to Lead, whether it dissolvs or remains intire; if it fastens upon the Oar without the help of any Material, it is a sign, that the Oar doth attract it to it self, repeat the operation so, untill you find that the force of the Silver, and the repetition doth wast

the

the Quickſilver, which if it do the work is excellent, and will produce the Silver in duſt as ſmall as Pin-duſt, which muſt be gotten together by ſearſing, and the remainder which is mingled with Quickſilver muſt be gotten by waſhing, and ſo you ſhall have all that the Oar contained, agreeable to the experiment, which was made by melting. The Oar of *Berenguela de Pacages* is of the quality afore mentioned, a great deal whereof was ſpoiled at firſt, by working it with materials, ſuppoſing it impoſſible there ſhould be Oar, which did not ſtand in need thereof; now adays they Refine with only Salt and Quickſilver, and get the ſame quantity of Silver, as they did by melting, which is all that the Oar contains; this Oar is called *Cobrico*, if the Enſay doth ſhew Lead, for ſo they call it, when the Quickſilver loſes its own bright colour, and looks like Lead, then other materials are requiſite to cleanſe it, that it may the better take hold of, and gather the Silver together; thoſe materials that have this virtue are Iron diſ-

ſolved,

solved, Lead or Tin, and Lime slacked, or unslacked for some resemblance it hath to Mettal; any Oar may be Refin'd with the help of any one of these materials, although that seems to b best, which is neareſt of kindred to the mixture of the Oar. If the dust of the Silver and colour of the Quicksilver be dusky and blackish, then Iron is most proper for it, for that which looks like Lead, Lead it self is best to that which is clear; Tin is the best for Quicksilver that looks as if it were guilt and hath Copper in it; Lime is the best this material which is most convenient they throw in by a little and a little at a time by measure and weight, untill the Quicksilver look clear, and lay hold on the Silver, and by this they make the account by the great, how much materials they are to put into a Caxon or Chest, according to the number of kintals it contains.

If the Quicksilver be changed into white pouder or Ashes, and often passing it again through the Oar, do not make it finer, it proceeds from the weight

weight and ſolidity of the Oar; the proper accidents of thoſe they call Soroches and Magagitaes, and thoſe other Oars that ſparkle and have need of burning, as have been ſaid before. Hard ſtones that have no Silver in them cauſe the ſame accidents in Quickſilver, wherefore looking upon it reduced to white pouder as aforeſaid, if you do not diſcern either black Oar or Margagita amongſt it, there was no Silver contained in that Oar which was Enſaid, and is good for nothing.

If in the leſſer Enſay the Quickſilver be bright and entire, and falls to work, laying hold on the Silver, there is no need of uſing any other material, all Enſays are made with a very little Quickſilver, that there may be room to uſe any other materials, if there be occaſion for it, if not that more Quickſilver may be added, and ſo the work of Refining is perform'd with greater brevity and ſecurity, as ſhall be ſhewed hereafter; and let not the Refiner ceaſe making experiments, untill the leſſer Enſay which he makes by Quickſilver,

cor-

correspond with that which he makes by melting, and let him proceed respectively in the greater Refining of the Caxones.

CHAP. XIII.

Continuing the Rules of the last Chapter, touching Oar that has need of burning.

IF the Oar have need of burning, as hath been said before, and the Ensays by melting made, and the Refiner assured of the quantity of Plate the Oar contains, let him burn it, observing the rules of what he is to mix with it according to the bigness of the work, and the convenience he hath to perform it in, but in no case let him burn any Oar with Salt; besides that it helps to calcine the Silver, it gives a stronger force to those ill fumes which are in the Oar to penetrate into and spoil the Silver. One cannot well tell the set number of hours, wherein one ought to let Oar con-

continue in the fire, but the ſure rule to know when the Oar is well conditi-on'd, is by Enſaying ſome of the burnt Meal; when if the Quickſilver remain intire and clear, and Silver ſticking about it like driven Snow, then it is burnt enough, and the fire continued, will certainly produce this effect if the Oar be mingled with due materials, and in a juſt quantity; in order to which, as alſo in the Oars they call Pacos, let them make leſſer Enſays to know what quantity of Materials are to be put in-to the Furnace with every Kintal of Oar, but becauſe theſe Enſays are ſel-dom made as they ſhould be, let the fol-lowing rules be obſerved.

When the Oar in the Furance leavs ſmelling ill, it is a ſign that it has diſ-charged it ſelf of all the Sulphur and Antimony that is in it; when that Oar charged with Betun, and at the firſt coming into the Furnace, throwing out a thick and black ſmoak by degrees, ſends forth a thinner and whiter fume; it ſhews that inconvenience to be cu-red.

When

When Oar changes colour, losing the sparkling that it had, and of *Negrilla* becoming *Pace*, 'tis a certain sign that it is well disposed for the Quicksilver, although in this there be exceeding great latitude.

That Oar which contains Copperas, if it be to be put in the fire, must first be cleansed by washing in Meal, as hath been said, otherwise when it comes in the Furnace, it will become very red as may be seen if one burn Copperas alone in the fire.

When Ensaying a little of the Meal burnt, the Quicksilver begins to look like Lead, it is a sign that by the heat of the fire the Copper or Iron which the Mettal contains (together with the mixture of Sulphur) the Antimony or Margagita are turning into Copperas, and that the faster, the longer the fire continues.

Take a pound of the Meal out of the Furnace, whilst it is hot put it into a Vessel, and pour water upon it three or four fingers deep, then stir it a while and let it settle, then if the water turn white,

white, or ſtain ones Nails, or change the colour of the Taggs of points put thereinto, it is a ſign that the Silver calcineth and diſſolves in the water like Salt; ſave this water in a glaſs veſſel, and pour more upon the Oar two or three times, or as often as is neceſſary, till it do not turn white; and all the Silver that was calcined, will be gotten out of the Oar; let the water evaporate by a gentle fire, and all the Plate will ſettle in the bottom, and become fit for uſe by melting.

If the water into which the hot Oar was put, give no ſigns of the Silver being calcin'd, dip poliſhed Iron into it; and if it come out coloured like Copper, there is much Copperas in the Mettal; wherefore waſh the Mettal in the manner as hath been taught, untill it be cleared of the Copperas, and change not the colour of Iron; ſave the waters of this operation, for they are very uſeful in the Refining Oar that have need of it, and if you ſhould take out and melt the Sedement that is in the bottom of that water, fine

Copper

Copper will be produced thereby, or Silver if any such have been calcin'd.

Ensay the Oar so disposed in little by Quicksilver, as hath been said of the Oars Pacos, untill by experience you have found out the way how to Refine in greater quantity, so that you may get as much Silver as you know that Oar contains by Ensays of melting in the fire. Let no body condemn these for tedious and unnecessary curiosities, for there is nothing more profitable and important in these matters, nor less commonly known; and by the care & pains of a few days the Refiner will be acquainted with the sorts and qualities of Oar that come to his hand, and know how to proceed with them without wearying himself with making Ensayes; but for all that have been said, the Oar never comes to be perfectly Refined, untill the Silver little or much that it contained be purified and whitned in the Meal, and it is not impossible to put it in that estate. Since the Oares Pacos of Lead may be reduced thereunto only by

by burning, and the Negrillos and others also that have Sulphur in them which staines and blackes the Silver, although it must be a long time in the fire before it comes to this, and both one sort of Oar, & the other must have boylings and liquors often passed through them, which do cleanse and whiten the Silver, such as Millo, Allum, Salt and others, the Oar being in this condition, needs no other material but Quicksilver, which in less than four days time will gather together all the Silver, and be very little consumed it self, because the short time of operation, the absence of ill qualities and the seldom times repassing it through the Oar, will not regrind, or disperse it to powder, which is the principal reason of the loss of Quicksilver, as shall be shewed hereafter.

CHAP. XIV.

Of the nature of Quicksilver.

DEferring untill another occasion, which it may be in due time will offer it self to treat purposely of Quicksilver, and some excrements thereof, of no less profit than curiosity; for the present, I shall only say with that Phœnix of Science in his intellective Art, which all do follow, who treat of the hidden Philosophy of Mettals, that Nature hath made this body of so uniform a substance, and of parts so perfectly united, that even the fire his greatest enemy, as the vulgar think, is not powerful enough by dividing to corrupt, and destory it as it visibly doth all other Mettals and bodies in the world, except Gold and Silver. The Quicksilver retains its whole intire substance in the fire, if it be prepared on purpose for it, which many persons know how to do, or else all of it will flye quite away in the form of smoak, and meeting with any

any body that refreſhes it; it will condenſe therein in its own proper form without being diminiſhed one hair, either in weight or quantity; neither alſo do the ill qualities that are ordinarily found in Oar corrupt Quickſilver in Veins wherein it is begotten, nor in the Cheſts wherein they refine, for although Copperas do diſſolve it in that manner that it ſeems to be conſumed; and being ſublimated in Copperas, and common Salt, it is transformed and turned into that which we call *Mercury*, that one would think it were totally deſtroy'd and turned into another ſpecies yet it is not ſo, but all thoſe accidents have their remedies, and it is neither impoſſible nor very difficult to quicken it again, and unite it, and in its place I ſhall ſhew how this is to be done.

CHAP. XV.

Touching the causes and differences of that which is called Lis.

QUickſilver diſſolved, and divided into very ſubtile parts, is commonly called by the Refiners *Lis*, which ſhews its ſelf like an eye-brow, in the matter *Purunnis* when the Oar is Enſayed, and from it the experienced Refiners take their indication of the quality of the Oar and condition of the Caxomes; it is cauſed by the often paſſing of it through the Oar (a thing inexcuſable in the ordinary way of refining) although it hath no ill quality at all, but if it hath Coperas in it, it will grind the Quickſilver in great extreamity, as hath been ſaid. If Quickſilver be without any foraign impreſſion upon it, and be diſſolved into *Lis*, which is white, 'tis called *Lis* of Quickſilver; *Lis* of other materials, is called that which is made by Quickſilver of Tin or Lead, and *Lis* of Silver is the fine, and ſubtile

ſubtile parts of Silver, made by the repaſſing of the Quickſilver through the Oar, but not as yet joyned or incorporated with it; which when it is, they call by the name of *Pella* (which ſignifies a Ball or Pellet) Quickſilver is ſuſceptible of divers colours, which appears in the *Lifes* according to the different matter which accompanies that Silver Oar into which it is thrown; theſe colours are reduced into three *Genuses* as it were, which comprehend under them ſeveral other *Species*.

Theſe three are { *Cleer.* / *Lead Coloured.* / *Spotted.*

The Quickſilver looks cleer, either when the Oar hath no Silver at all in it, or when the Silver it contains is fine without any Alloy or mixture; in that caſe the Quickſilver will attract, and cloath it ſelf with the duſt of fine Silver, without loſing the livelineſs of its color; which when it changeth, they call it Leaden, for its likneſs unto the co-

lour of that Mettal, although it always is accompanied with signs that the Oar contains Silver, unless it be that the Lead, for so they call it, proceed from false principles, and those have a manifest cause, although little taken notice of, as well as the other proceedings in Refining, which hitherunto have been governed by chance. It is Copperas alone (the mortal enemy of Quicksilver) which gives it the false colour of Lead, in like manner as it doth to other Mettals the colour of Copper; the other Lead colour is a certain sign of Silver, because ordinarily it is made in raw Oar, that is mixed with divers other bad things, the which attracting to it self the Quicksilver; the Quicksilver lays hold of, and carries away both the Mettal, and also its bad companions, who give it that strange colour; this is the ground of what is treated of in the twelfth Chapter of this Book, and the reason of that assertion, that the black or obscure *Lit*, or colour of Quicksilver proceeds from Oar that is mixed with Iron; if the Quicksilver have

have a deep Lead colour, then it hath Lead its ſelf in its company, if it be ſomething more clear, then it hath Tin, and if it look as if it were guilt a little, Copper. Whether the *Lu* be of Quickſilver, Silver, or of other materials is eaſie to be diſcerned, for the *Lu* of Quickſilver is very fine, white, but wanting quickneſs, and when it falls together with the water into the Tray, it doth not run up and down, but remains as if it ſtuck to the bottom, and if you rub it with your finger, it will unite into lumps of Quickſilver. The *Lu* of Silver ſhines, and is like Pinduſt, or finer according to the richneſs of the Oar, when they let the water out from the Oar, it runs about the bottom of the Tray, and if you rub it with your finger, it will gather together into Pellets; the *Lu* of other materials is as it were a middle thing between the other two, and being reduced into a body by rubbing it with ones finger, it unites it ſelf with the touched Quickſilver.

CHAP. XVI.

whether it be fitting at first to put in all the Quick-silver, and other materials at once or no.

THe Oar being in good disposition, and the Refiner by the foregoing rules being assured how much Silver the Caxon contains, and what proportion of Quicksilver and other Materials is necessary to be put in, that when it comes to be washed, it may yield three parts of Silver Pellets, and one of Quicksilver, it may be doubted whether all the Quicksilver and materials aforesaid, should be put into the incorporating vessel at once, or no; and the most part, if not all the Artists of this Country did use to do it at once; untill about twenty years ago, when I came to live in the Province of the *Lipes*, I perswaded them to the contrary according to rules, which I had learnt in such like operations, out of *Raimundus Lullus*, which do evidently agree with

with the ordinary courſe of Nature, that brings to perfection all thing by a ſlow and gentle growth, and not ſuddenly nor violently. A very little fire is ſufficient to burn the whole world, if the combuſtible matter were put into it by little and little, proportionable to the force of the fire; but if all that matter, or an over-great proportion of it ſhould be laid upon the fire at once, it would choak it, and put it out: the natural heat of Animals is ſubject to the ſame inconvenience, and the ſame happens proportionally unto the Cheſts of Mettals, beſides that by experience it is found, that the extraordinary cold of much Quickſilver, doth accidentally bind up the Oar, and hinder the Refine, as on the contrary any heat haſtens it; moreover if becauſe they have judged ill of the remedy to be put into the Cheſt, the Caxon deſpair, and the Quickſilver diſſolve, the remedy will be the eaſier, the leſs looſe the Caxon. And if there be need of uſing Tin or Lead, which cannot be applyed without Quickſilver, that will be added

with

with leſs danger, the Quickſilver being in already. The ſame damage or greater follows when they exceed in the quantity of Materials, they put into the Oar which hath need thereof, becauſe it dulls and deadens the Quickſilver, ſo that it will lay hold on no Silver at all, and can very hardly ever be reduced into that condition it ought to be. After many days ſpent in repaſſing the Quickſilver, and dreſſing of the Oar, let the Caxon be incorporated and waſhed with a third part of Quickſilver at the moſt, and at firſt put in half the Tin or Lead, that is requiſite to be ſpent, for ſo the Quickſilver will the better lay hold of the Plate, and draw it out preſently before the Materials are conſumed, which they call *Aplomar*, whereby will be avoided the danger of the dry Plate, which like froth ſwims upon the water that comes out, and is the occaſion of much miſchief. If the Caxon ſtand in need thereof, proceed to put in more Quickſilver, and other Materials, always diminiſhing the quantities proportionally in ſuch manner,

manner, that it may go dry and not wet; for so there will be no occasion for much *Lie*, and the Pellets themselves will serve to get out the rest of the Silver, whereby the refining will be soonest and most securely performed; if it be needful to Refine with Lime, the rule already prescribed for Materials will not serve, but the Lime must be put in all at once, and with it repass the Caxon very well two or three days before you put in the Quicksilver, taking especial care that you do not put in too much of it, because it is the great hinderance that the Quicksilver doth not lay hold of the greater Plate, and it is more hard to correct than other materials.

CHAP. XVII.

Of the often repassing the Quick-silver through the Oar and the effects thereof.

THe chief and principal end of letting it soak through, is to divide the

the Quickſilver into ſeveral bodies; that it may every where lay hold of the Plate, alſo with that motion it is heat, and better diſpoſed for the work; and laſt of all by that frication the Plate is cleanſed and purified (which is that they call waſting the Materials) all of them, things moſt neceſſary and important, although they cauſe an unpardonable damage, that hath been the loſs of many Millions in the waſting and conſumption of Quickſilver, for the repaſſings have been the foundation of this inconvenience, by ſqueezing the Quickſilver through the groſſer and finer parts of the Meal into ſuch little Atomes (which they call *Li*) that ſcarce have weight or dimenſion, which when they waſh, the Caxon doth not fall down into the Tub at the bottom, but being over-drowned and mingled with the Lamas or mud of the Meal, it ſtays and is caſt away with them; this inconvenience may be prevented by two cautions, the one is, that the firſt and ſecond day after the incorporating of the Meal of Oar in the Caxon, they give not above

above two gentle repaſſings, ſo that the Quickſilver may be divided, but not into too ſmall parcels, becauſe before it hath gotten a good body of Silver, it is ſubject to part it ſelf over finely. The ſecond is as aboveſaid, that they put in the other materials dry, and not wetted with Quickſilver, putting them in by little and little when moſt it be in the proportion, one part of Quickſilver to two of Pellets. Let no body deceive themſelves, that although the Meal in the Caxon contain other Materials ſufficient, if it be much bathed with Quickſilver that it ſhall be ſecured from the former inconvenience; for contrariwiſe it will rather be ſubject to a greater prejudice, for of neceſſity the repaſſings will make *Lis*, and if it happen by ſome accident as it very well may, that the Materials be quite conſumed inſtead of the *Lis* made of them will remain only *Lis* of Quickſilver. In the *Lis* of Plate there is not that danger, that by the often repaſſings the Silver ſhould be waſted or conſumed, rather it is thereby better refined, and better embraceth

weth and uniteth it ſelf with the Quick-ſilver.

CHAP. XVIII.

Of divers accidents, which happen in the way of Refining by Quick-ſilver, and their remedies.

IN the progreſs of this kind of Refining, divers accidents are met with all in the Caxones (or cheſt full of Oar grownd to be Refined) all which are diſcovered only by the Quickſilver, which as in a glaſs repreſents the good or ill diſpoſition of the Metral, which in themſelves by reaſon of the fineneſs of the Meal into which they are grownd, and a mixture of earth in the Oar, cannot be diſcerned.

If the Quickſilver be very much charged above what it ought with materials, that is to ſay, Lead, Tin, Iron, or Lime (which the *Spaniards* call Quickſilver Tocado) it will not appear round but flatted, or rather prolonged like

like little Worms, and if you ſtir it about the Tray without water, it will make drops with little tailes, and ſtick to the ſides of the Tray; and when it is of this condition it is a ſign that it is killed, and its virtue obſtructed from laying hold of the Silver; this evil is remedied by much repaſſing, not without great coſt and expence of time; the quickeſt and moſt efficacious remedy is Copperas, or the water thereof, which I have ſhewed how to make and to keep in the 13. Chapter of this Book, put it into the Caxones at the ſame time as you do the Quickſilver, and other Refining Materials more or leſs, according as there is occaſion, and you ſhall inſtantly ſee the effect of it; the reaſon whereof is plain, for (as hath been ſaid) Copperas diſſolved in water converts the baſer Mettals into true Copper; ſo that the quality of cold which they had before, and wherewith they choaked the Quickſilver, being turned into heat (the property of Copper) it is the cauſe of reviving the Quickſilver: From hence is grounded

the

the practice of putting Copper grownd ſmall into the Caxon, which is found very profitable for the purpoſe aforeſaid; hence alſo it comes to paſs, that all Oar of Copper although it be rich is not proper to clear Quickſilver with, or to be uſed in the Refining to make it Aplomar, unleſs it have a great deal of Verdigreaſe or Copperas. The ſame account may be given of the Virtue that is found in thoſe they call Magiſtrates, which they uſe in the Refining to qualifie the Caxones with heat, and to make them Aplomar, the which effect is produced from the burnt Copperas that is in it, as may be ſeen in their compoſition, which for better ſatisfaction I ſhall here ſet down.

Burn Oar or Copper, and grind it well, then with an equal quantity of Salt knead it into a body together, and having made it into loaves burn it again.

Others do mingle but one part of Salt, with two parts of Copper Oar, which they make up into a body and burn, and to one Kintall of that beaten

to

to ponder, they add half a pound of filings of Latin.

Another Magiſtral is made of Lamas, Relabes and Salt, an equal portion of either ſoundly burnt together.

Another is made of that Oar wherewith they Refine the Relabes and Salt put together in equal portions.

Another ſort may be made of Copper Oar, Relabes, Meal of that Oar which is to be Refined, droſs of Iron and Salt, all put together in equal portions and burnt in loaves.

Another is made of three parts of the Lamas burnt, and one part of Salt. Every one inventing ſuch like compoſitions or proportions, according to his own fantaſie, and experience: the foundation of all theſe Magiſtrales being the Copperas which the fire produces in them, as may be ſeen and ſeparated from them, by whoſoever ſhall pleaſe to go about it according to the rules that have been already delivered, which ſeems to confirm that which *Pliny* ſays,

treating of Copper, namely that it is begotten of ſtones burnt.

Theſe Magiſtrales are to be uſed with the ſame carefulneſs as hath been already ſaid of the materials, namely they are to be made trial of before the incorporating of the Caxon, that by theſe leſſer Eſſays it may be known what proportion is fit to be put into the Caxon, according to the number of Kintals it ſhall contain, for if the proportion do exceed, another great inconvenience will be produced thereby, namely that which follows.

CHAP. XIX.

In proſecution of the Chapter foregoing.

AN Accident contrary to that mentioned in the former Chapter, and an occaſion of great waſte of Quickſilver, is of the colour of Lead, that is to ſay, when it is affected with no other mate-

material of inconvenience, but only that diſcolouration, and the damage is the greater, if the diſcolouring hath proceeded from Copperas, and that there be much Quickſilver divided, and running looſe about. Quickſilver ſqueezed out of the lumps is very round and lively; if it be divided, the parts of it, although never ſo ſmall, do not run into a Cylindrical figure, but into a Spherical, this miſchief is cured by the contrary materials, which as hath been ſaid before cleave unto the Quickſilver, nevertheleſs the Medicine, which by its particular qualities, attraction, and natural ſympathy cure this evil is Iron, which reunits the Quickſilver, and gathers it together into a body after it was diſſolved, corrupted, and in a manner turned into another ſubſtance by the Copperas, which ſhall be treated of more at large hereafter, when we ſpeak of waſhing the Caxones.

No certain rule can be given, what quantity of materials to put into the Caxones, that have failed in the operation, becauſe the miſchief and the cauſes

thereof are not always the ſame, but this general rule muſt be obſerved, that they do not repaſs the Caxon with Quickſilver, till they have firſt Enſayed a ſmall quantity thereof, and thereby have underſtood what is neceſſary. After that let them take a third or a fourth part of the Caxon, and mingle that with the whole proportion of the Materials, and ſtir it well together, till it be very well mixed, and incorporated one with another, then mix this with the reſt of the Caxon, ſtir them very well together; for after this manner the Medicine will be beſt, and with moſt equality diſtributed in the Caxon, eſpecially if the Medicine to be put in be very ſmall in quantity. Have a care to uſe the means, that is requiſite to avoid falling into the firſt inconvenience of overcharging the Quickſilver, and remedy the ſecond miſchief with all poſſible ſpeed, becauſe otherwiſe the Copperas will transform the Quickſilver in ſuch manner, as if it were quite eaten up and conſumed. When Enſaying the Caxon the Quick-

ſilver

ſilver is found in the bottom of the *Purrumia* Veſſel divide it in ſmall grains not run together in a lump, it is a ſign the Refination is imperfect, and that ſome little hairyneſs, or criſping encompaſſeth the Pellets of Quickſilver, and hinders them uniting; the want of materials is commonly the cauſe of this, or elſe the over-much allay of other Mettals, which as well as the Plate attracts the Quickſilver it ſelf. Repaſſes, the Relabillo burnt by reaſon of its ſharp cutting quality is profitable to cleanſe the Quickſilver: ſome put in aſhes, but the moſt proper and natural remedy for it, is that which they call Millo or Allum, which makes the Silver white, and is very ordinarily to be had in great abundance amongſt the Mines here at *Potoſi*, and in *Guaico de Santiago* there is a Spring that runs continually with this Allum water.

When the Caxon hath not been repaſſed equally, or not ſerved with as much Quickſilver as is neceſſary, or in ſome places doth not unite it ſelf with other parts of the Quickſilver, that had

gotten Plate already, the cauſe thereof is that they call dry Plate: In Enſays you ſhall ſee it ſwim upon the Relabes criſped like froth, and if it be not ſcimmed off, and ſaved before the cleanſing the Caxon, it will ſwim at the top, and run away with the Lamas to the great detriment of him that owes the Oar; if the Quikſilver dry, having nevertheleſs materials ſufficient with it, it is no inconvenience at all, becauſe it will unite one with another the better, or elſe that part which the material poſſeſſed being waſted away, the other moiſt parts remain in the Quickſilver to unite it ſelf with the reſt of the Pellets; that dry Plate which wants materials, cannot ſafely be gathered together by looſe Quickſilver, untill the Caxon be ready for cleanſing; the proper remedy for this is to repaſs the Caxon with Pellet of Silver, not over ſmall, ſo ſhall the dry Plate be collected together, and the greateſt part of the *Lis* alſo, if there were any there.

CHAP.

CHAP. XX.

How to know whether or no the Caxon be ready for washing.

THere can no certain time be prefixed, wherein one is obliged to wash the Caxones. It's maturity is hastened by frequent repassings by the outward heat of the Air, and the inward heat of the Copper or Copperas, and other things of that kind of virtue, and such as clear and purifie the Silver; a principal cause whereof is the burning of Mettals. On the contrary, the work of Refining is prolonged and slackened by fewer repassings, if the Air be cold or Frost, if the Caxon be over foul, that the Quicksilver loses it's clearness in passing through: but letting pass these, and other accidents, let us come to the point of gathering out the clear Silver mixed with Quicksilver, leaving the earth behind, which is called washing the Caxon, whereunto no small experience is necessary, for if the

Caxon be not ripe for washing, that plate which the Quicksilver hath not laid hold on, is likely to be utterly lost, or if it be not, it must be grownd over again, so that at least one loses much time and labour, and Silver too in the repassings, besides other hazzards.

The rules hitherto delivered for the discovery of the disposition of the Caxon are subject to very great error; such as it's appearing so well to sight as if there were need of no more Quicksilver, to find the *Lix* of the Plate all gathered together and finished, and that of the Quicksilver beginning to come; the substance of the Plate, and Quicksilver being clear, and gilded as it were with other signs, all of which do not secure the judgment from being erroneous, because these may be produced by other accidents besides the maturity of the Caxon. The only sure and infallible sign is to see whether the Quicksilver hath gotten all the Plate, which it ought to do according to the proportion shewed by the lesser Ensay of fire, which was made at the beginning, and if it hath

hath not arrived to that, although it hath many more good ſigns than hath been already mentioned; waſh not the Caxon, but take more ſmall Enſays thereof, whereby you ſhall eaſily prove what Plate it contains, and what remedy is neceſſary to bring it to full perfection, which when it is attained, and the refined ſubſtance alone contains the aforeſaid proportion of Quickſilver and Pellet, ſtrow ſome Quickſilver looſe upon it; and therewith gently repaſs it two or three times in ſuch manner as it may go into the Copper better bathed, in the proportion of three parts Pellet, and two of Quickſilver, or at leaſt two of Pellet and one of Quickſilver; then gather up ſome of the *Lis* that remains, and put it to the dry Plate, and to the whole Maſs of Pellet, whereby they will be more weighty, and ſink better to the bottom of the Caldron, and will riſe and waſt leſs in the boyling; throw Quickſilver alſo looſe into the Caldron (which they call a Bath) when it begins to be liquid, incorporate therewith that which the Caxon contained, and it will

will help to unite it the better, and the more Quickſilver there was, the fewer inequalities like Oyſter ſhells will be produced.

CHAP. XXI.

That the waſhing of the Caxones cauſeth the loſs and waſte of Quick-ſilver.

ALL the inconveniences that are and have been found in the waſte of Quickſilver, which they term either loſs or conſumption of it, are cauſed by the waſhing the Caxons; until then nothing hath been loſt, however one may be deceived in Judging by the view even in occaſions, that have ſometimes happened and may happen again, that they find neither Quickſilver nor Pellet of incorporated Mettal in the Caxon; for accidents alone as hath been ſaid, cannot alter the Quickſilver ſo as to corrupt and deſtroy its ſubſtance; in the Caxon it is howſoever more or leſs diſpoſed to get out inperceptibly with the

the water of with the Lamas. The immediate cauſe of this miſchief is when the Quickſilver is made over thin without body or weight as it were, ſo that it hath nothing to ſink it to the bottom of the Caldron, and with the ſtirring the Caxon when they waſh it, it mixeth it ſelf with the dreggs and durt, and goes along with them, and there wants more or leſs of the Quickſilver they put in at firſt, according to their better or worſe ſtirring the Caxon and quantity of *Lis*. It hath been a great error in thoſe, that becauſe for ſo many years the beſt Refiners in theſe Kingdomes have waſted at the leaſt ſo much Quickſilver, as they have gotten Plate, therefore the Quickſilver is really and truly conſumed in the operation, not animadverting the evidence to the contrary, which continually paſſeth through their hands, namly in the Lamas and relicks of the Caxon where the Quickſilver hath oftentimes ſtayed behind, accompanied with a conſiderable quantity of Plate, which the owners of Oar have experimented to their great damage,

and

and the buyers and Refiners of the relicks of the Caxon to their great profit and advantage. Others ſpeaking Philoſophically ſay, the cauſe of the conſumption of the Quickſilver proceeds from the contention and combat, which it hath with contrary qualities before it can lay hold on the Plate, and that thereby it is debilitated and conſumed; theſe men ſay ſomething to the purpoſe if they could demonſtrate the contrary qualities that are between Quickſilver and other Mettals, between whom there is rather a great ſympathy & agreement, Quickſilver being the principal whereof all other Mettals are made, and alſo of the Minerals that ordinarily do accompany them, but if theſe men cannot prove the cauſe, neither will the effect which they ſuppoſe, namely the deſtruction of Quickſilver follow, and there is certain experience to the contrary, and hereafter ſhall be ſhewed a way how to recover all the Quickſilver, even out of the Caxon, that is moſt ſpoiled in operation, and ſo moſt difficult to do it in.

CHAP.

CHAP. XXII.

The true cauſes of the loſs of Quick-ſilver, and their remedies.

THe repaſſings are the remote cauſe of waſting of the Quickſilver, which is thereby ſtrained and divided into very ſmall parts which they call *Lis*, and although into whatſoever Oar, Earth or Sand you throw Quickſilver, and repaſs it, you ſhall find the effect aforeſaid, yet it is moſt of all experimented in thoſe Oars which are called Soroches, which by their weight and glaſſie quality, do more eaſily cut aſunder, and divide the Quickſilver into minute parts.

Copperas is of its own nature a violent cauſe of extenuating the Quickſilver, as hath been often ſaid, and hath been the cauſe of the waſt of the greateſt part of the Quickſilver that hath been deſtroyed. There be other cauſes, which accompany and aſſiſt the two former in working this ill effect, one is the

the Salt, which they uſe in Refining, and wherewith they waſh the Caxones, which every body knows thickens water, whereby not only the ſmall *Lis* of Quickſilver, but alſo heavier things ſwim and cannot ſink to the bottom.

The Lamas which is mingled with the water, and troubles it in the Caldron thicknes it, and doth yet more reſiſt the ſinking of the Quickſilver which ſtays and is thrown away together with it.

Laſtly, the motion of the inſtrument wherewith they ſtir the Caxon when they waſh it by condenſing the force of the cauſes aforeſaid, hinders the *Lis* from ſinking, and crowdeth it up to the top. The ordinary repaſſings in this way of Refining cannot be wholly excuſed in this matter, but if the rules already taught, be carefully obſerved, the damage will be the leſs: likewiſe already hath been ſhewed the way to clear Oar from the Copperas, and to clear the Margagitas from their heavy and glaſſie qualities. Salt may be gotten out of the Caxones two ſeveral wayes, and pre-

preſerved for uſe to the ſaving of many Ducats a year, now commonly ſpent in that commodity; put the Oar into Caxones made ſmooth and round on the inſide without corners or Angles as is often uſed, let them ſtand a little ſlooping, only ſo much as is neceſſary, that all the water may run to one part of it, where there muſt be a hole for it to run out at in convenient ſeaſon, but ordinarily kept ſtopped. When the Caxon is ready for waſhing, fill it with abundance of water, opening and ſtirring about the Oar with the hove, that the water may penetrate through it the better, and having done ſo a pretty while, open the hole, and let the water out into a Veſſel provided on purpoſe to receive it, where it will either congeal into Salt, or remain in liquor as it is, will be ſerviceable for the operation of other Caxones; repeat this two or three times untill the water that comes out doth not taſte brackiſh. If the Caxon was to have been waſhed in three Caldrons waſh it in ſix, whereby the water will come out twice as

clear,

clear, and with very little Mud, or Sediment.

The Peſtel wherewith they ſtir the Caxon, muſt not be uſed always in the ſame hand, becauſe the cricles going conſtantly paralel, the ſmall parts of the Quickſilver, and the dry Plate go along together with them, and never encounter one another to unite themſelves into a bigger body that they may ſink to the bottom, wherefore after five or ſix turns with the right hand, take as many more of the left, and ſo proceed; and becauſe this cannot ſo conveniently be done in the ordinary waſhing places, put into the Caldron a thing like a broad Peel, which oppoſite to the courſe and motion of the peſtel may diſturbe the march of the Quickſilver and dry Plate, and cauſe all the content of the Veſſel to meet and unite, excepting that which is at the bottom whereof there is no neceſſity, becauſe of the bath which it is to ſuffer. Cover the Veſſel with Plates of Copper, or Iron Quickſilvered, to which ſide ſoever of the Veſſel the *Lis* comes, it may

may ſtick thereunto, when the Caxon is waſhed the *Lu* is eaſily gotten together, by ſweeping the ſides of the Veſſel with a peece of ſhoo leather, a peece of a hat, or a peece of cloath.

CHAP. XXIII.

To make the Pine Apples, *and to clear them of the Quick-ſilver.*

HAving taken the Plate and Quickſilver together out of the Caldron, and ſtraining it through two courſe cloaths wetted, to make them the thicker, having beaten it alſo with a Battledoor to ſqueeze as much Quickſilver through the cloathes as is poſſible, make Pine Apples of the dry Pellets in moulds fitted for that purpoſe, which are called Pine Apples from their ſimilitude to that fruit by reaſon of their Pyramidal figure, and

of thoſe Pines that have been reaſonably well ſtrained, the fifth part will be Silver, ſo that one Hundred pound of Pellets will produce twenty pound weight of Silver. The Pines that are made of richer Oar ariſe to leſs profit than thoſe that are made of poorer, becauſe the Plate in the richer Oar is more courſe and ſpungy, than that which is contained in the poorer. In the ſtraining of the Quickſilver though never ſo carefully, ſome ſmall parts of the Silver will go along with it, and the more in quantity by how much the more moyſture there was in the Pellets when they began to ſtrain them, the like whereof is ſeen in water mixed with clay, which although it be ſtrained with never ſo much care, will not look clear and pure but muddy and troubled by reaſon of its mixture with the durt, and the great quantity of water there was, the more durt ſtraines through along with it; letting it ſtand quietly a while it will ſettle and gather it ſelf together, and leave

the

the water clear. In like manner, in the Veſſels wherein they preſerve the Quickſilver after they have done refining, and made the Pine Apples, after a few days the Pellets of Silver will ſettle and gather into a body together. In the refining work of Saint *Catherines* in the *Lipes* out of the Veſſel, wherein they kept their Quickſilver, I ſaw as much Plate gotten of the kind aforeſaid, as would have made a good great Pine Apple.

If the Quickſilver be heated it becomes thinner, and will carry away more Silver in the ſtraining, alſo when the Pellets are ſtrained, that are gotten by boyling although it be done with very much care, yet Plate will paſs along with the Quickſilver, and if you will let it ſtand a days time to cool and ſettle, and ſtrain it again, you will get more Pellets of Silver.

The loſs in clearing the Oar again from the Quickſilver hath been great and irrecoverable, as may be gueſſed from the experiment thereof in this Imperial City at this preſent, when the Trading in Mettals runs but low, and yet *communibus annis* above thirty thouſand peeces of Eight are waſted by the expence of Quickſilver, how vaſt a ſum then hath been ſpent by Quickſilver in the many other very rich Mines belonging to this Kingdom; this inconvenience hath proceeded from want of care in ſeeing that the Canones and Caperucas (which are the names of the Veſſels they uſe in the recovering the Quickſilver) be made of very good ſtuff, and ſhut curiouſly cloſe in the Place where they joyn together. The clay whereof uſually they are made is very ſpungy and full of Pores, ſo that the water ſoaks through and ſweats out at them; then it is no wonder that the Quickſilver attenuated by the violence of the fire (which widens the Pores of

of the Veſſel alſo) evaporates through the ſame, and is exhaled and loſt: to ſay that any part of the Quickſilver is deſtroyed or periſheth by the heat of the fire is onely the imagination of thoſe that underſtand not the uniformity of its ſubſtance, as hath been ſhewed before. Make the Caperucas and Canones of ſuch ſtuff as you make the Cruſiples, and that inconvenience will ceaſe, and the Veſſels will laſt for ever (becauſe they are ſo mightily condenſed and reſiſt the fire) unleſs ſome accidental blow or knock do break them. In that noble Town of Saint *Phillipi* of *Auſtria*, *Oruro*, famous for abundance of Mines both of Gold and Silver, on the top of a little hill which ſtands above the Church of the *Ranqueria*, there is a little vein of white earth, whereof they make Veſſels for uſe, which after they are baked become ſo cloſe and firm that they are not inferior to the beſt *China*. I was the firſt that made try-

all, and publiſhed the uſefulneſs of it for the making of Cruſiples with very good ſucceſs to thoſe that had need of them, and I do not doubt but there is ſuch kind of Earth about this City of *Potoſi*, where nothing hath been found wanting that any wiſe belonged to the obtaining or refining of that abundance of riches, which nature hath beſtowed upon it; although hitherunto much buſineſs, and a ſhort time of abode here, hath hindered me from finding of it out. But where ſuch kind of earth is wanting, mingle the Clay whereof you make theſe Veſſels, the better with the ſcum or droſs of Iron grownd very fine, and make it up and bake it very well, and there ſhall not be ſo much Quickſilver loſt in the uſe of them as is by thoſe now in common uſe. The Canones muſt be glaz'd on the inſide, the Caperucas not, becauſe the violent heat will melt the glaſing, and make it run.

CHAP.

CHAP. XXIV.

Other safer ways of clearing the Pine Apples from Quick-silver.

THe best Vessels for this purpose are made of Iron or Copper beaten to the thickness of a peece of Eight, or somewhat thinner, and for more security, that the Vessels may the better endure the fire, they cover the Copper Vessel with a coat of good earthen ware on the outside; not many years ago, some people began to use these Copper Vessels cased with earthen ware, and left them off again, because they understood not the nature of them, nor how to use them. The like happened in the Province of the *Chickas*, who cased their refining Vessels as abovesaid, because they heard that in their neighborhood in the *Lipes*, I was working after that

manner. The cauſe of theſe miſtakes ſhall be ſhewed in the diſcourſe which follows.

The ſhorteſt, beſt, and moſt ſecure way of clearing the Pine Apples from Quickſilver is in this manner; make a deep Veſſel of Iron wider at the top than at the bottom, containing more or leſs according to the quantity of Mettal intended to be cleared at one time, ſet it upon a Trevet of ſtrong Earthenwere, or of Iron caſed with Earth in a Furnace of ſufficient bigneſs to put Wood or Coals under it, as occaſion ſhall require at a mouth made for that purpoſe; the reſt of the Furnace both the top, bottom, and ſides is to be very cloſe; excepting one little hole at the top where it ſhall be found moſt convenient to give reſpiration; diſpoſe the Veſſel aforeſaid in ſuch manner as they do that which they call the Cannon in the ordinary way of uſing Quickſilver; ſo that it may look out above

the

the top of the Furnace one large fingers bredth or two, that it may the better joyn with another Veſſel to be put a top of it, which may ſerve inſtead of the Caperuca; put the Pellet (or Mettle aforeſaid) well kneaded together in Cakes of what form you pleaſe into the Veſſel, and leſt the Plate ſhould melt and ſtick to the Iron Veſſel, let it have a thin coat on the inſide of Earthen ware; or ſuch as Cruſibles are made of, cover this Veſſel with a large Limbeck head made of hammer'd Iron, or Copper, or of very good Earthen ware well glaz'd, and out of it draw a long Pipe a little ſloping, the cavity whereof in the narroweſt Place, namely the extremity, let be no leſſer, than the bigneſs of ones little finger, let the joyning of the Limbeck with the Veſſel below it, be ſtopped very cloſe with galt, then in a ſecure place that doth not feel the heat of the Furnace, let there be placed a great Veſſel of ſtone or of other matter full of cold water, where-

whereinto let the nose of the Limbeck enter two fingers breadth, blow up the fire in the Furnace from which the Quickſilver flying in the form of vapor to the top of the Limbeck, the coolneſs whereof preſently reduceth it into a body again, which runs down through the Noſe into the Veſſel of water aforſaid, the Limbeck ſhould now and then be cooled on the outſide with wet cloaths, and the water into which the Quickſilver falls as it becomes warm ſhould have more freſh water added to it.

A. The deep Veſſel of Iron, or Copper.

B. The head of the Limbeck.

C. The Noſe of it.

D. A Trevet.

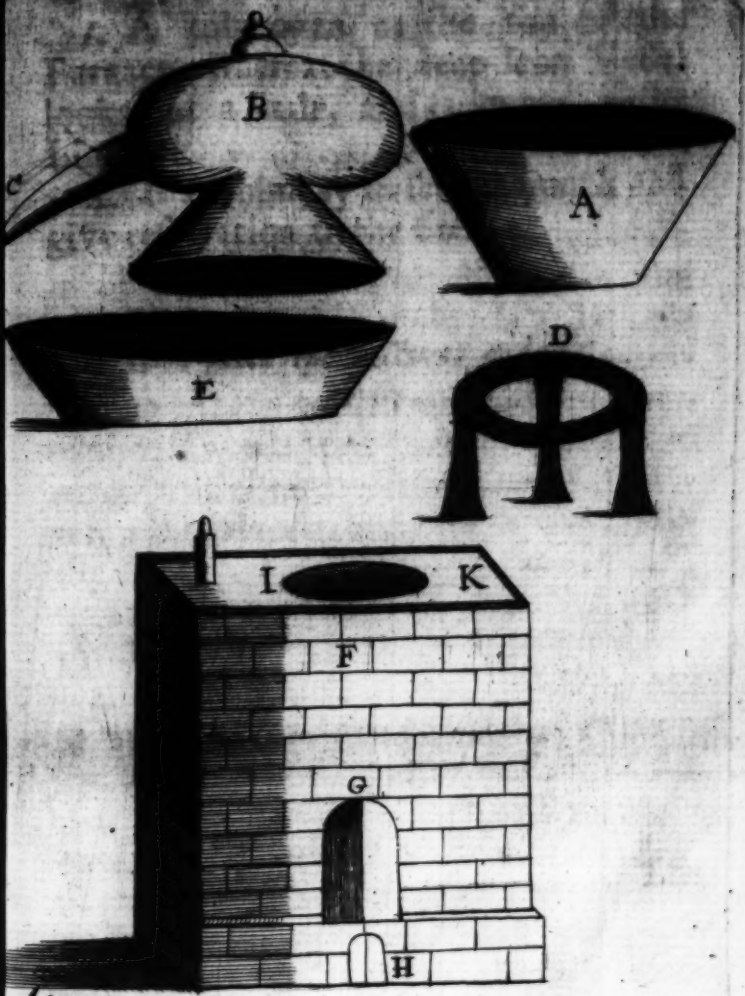
E. A Baſon or Veſſel of water to receive the Quickſilver in.

F. The Furnace.

G. The Mouth of it.

H. The hole to draw out the aſhes at.

I. A



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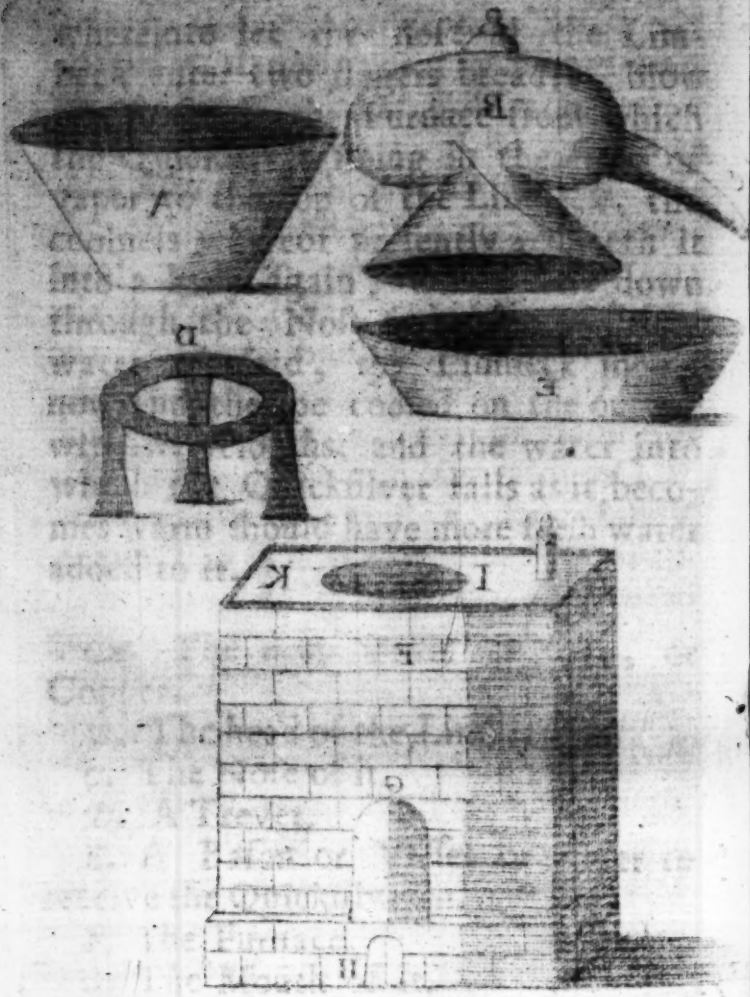
A
B
C
D
E
F
G
H
I
K

I. A hole open at the top of the Furnace, whereat the deep Iron Vessel looks out a little, and is joyned to the Limbeck.

K. Is a Chimney to let out smoak and give respiration to the fire.

Here place the Pictures and the Verses.

The

The trouble and hazard of keeping them close in the joynt with clay or galt, may be excused by making of the place where they shut one upon the other a handful and a half higher, or if to that size of them, that is now in use they put at the bottom on the outside, and fill it of two fingers broad; so that the lower Vessel may come up very close upon it, and cannot enter further into it, a little lower than the Caperucas come, are placed the Candlestick foot, as they call it, whereupon they set the Plate and the Pine Apple; the Candlestick foot comes up about four fingers higher than the mouth of the lower Vessel, which they call the Cannon in the which on the one side four or six fingers lower than the fire used to be, enters in a small Pipe of cold water at a hole made for that purpose in the Cannon without disturbing the Caperuca at all, because it is not to go in strait, but with a little liberty; over against this hole there is such another, out of which runs as much water as enters in at the former,

former, whereby the Canon is always kept full, and the water in good temper to receive the Quickſilver without any prejudice.

If one ſeparates the Quickſilver by the Limbeck, they may do the ſame thing, clapping a ring of Copper of two fingers breadth, and other two fingers deep to the mouth of the lower Veſſel; ſo that the other Veſſel may eaſily be let in and out, wherein the Quickſilver is to be ſaved. Into this Circle the Limbeck muſt be fitted, and to prevent its being blown off with the force of the vapor of the Quickſilver, the Limbeck muſt be kept down with weight on the top of it, or tying it to ſome other fixed thing, or making a ring on the top of the Limbeck paſs a bar of Iron through it, both ends whereof afterward remaining fixed in two walls built on each ſide of it for that purpoſe.

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FINIS.